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ABSTRACT

Drawn largely from the experiences of Bloomfield College (Illinois) with its Freshman Core Program, but citing other efforts to develop thinking skills as well, this essay considers several questions and issues concerning the cognitive skills approach to teaching. The paper begins by identifying some of the increasingly common learning problems which have stimulated interest in the cognitive skills approach in higher education. The next section of the paper explains that the cognitive skills approach grows out of a developmental view of knowledge; it seeks to develop intelligence by utilizing an active, problem-solving approach to classroom activities. Next, several methods of teaching cognitive skills are introduced and distinctive features of the approach are enumerated (e.g., intense verbal interaction, student-oriented instruction, motivation of students to learn, and a developmental emphasis). The following section of the paper focuses on training teachers to effectively use the cognitive skills approach, describing several faculty development efforts. A rationale for implementing the approach precedes a discussion of methods of evaluating its effectiveness. The final section outlines problems that threaten the effective continuation of the use of the cognitive skills approach at Bloomfield College. (AYC)

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DEVELOPING A COGNITIVE SKILLS APPROACH TO TEACHING

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DEVELOPING A COGNITIVE SKILLS APPROACH TO TEACHING

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Some Learning Problems in Higher Education

In two social psychology classes (one composed mostly of adult learners) students were asked the following question on an exam:

"Walking home I notice my shadow to be 8' long; a tree beside me casts a shadow of 20'. I am 6' tall. How tall is the tree?" Solve the problem, and indicate why, according to Piaget, a child of ten will most likely not be able to solve the problem.

While most students could suggest Piaget's reasons for a child's inability to reach the correct answer, only about 15% of the students could themselves solve the problem correctly. Most saw the problem calling for subtraction of two feet; they produced an answer of 18'. Only a few students realized that the solution involved seeing a ratio; these gave the correct answer of 15'. Several freshman science classes produced similar results. In fact a national survey indicates that many undergraduates cannot correctly solve this problem.

Dr. Jack Lochhead, Director of the Cognitive Skills Project at the University of Massachusetts, which sponsors a successful heuristic lab for physics students, reports that some students who succeed in physics nevertheless complain that they can't understand the course. There is a myth that students who don't understand physics are poor in math; on the contrary, he has found students very good in math who fail to understand physics. In confronting a problem, they plug in what they perceive to be the right formula and produce the right

answer. There are many students who seem to be able to perform perfectly well in their courses without understanding what they are doing.

An eminent sociologist complained at a large conference that graduate students manifest the same basic problem found in undergraduate essays. They can manipulate data, but they cannot analyze what they read and too often cannot begin to make an intelligent interpretation of it. Their thinking is mechanical and unreflective. They do not really understand what they read or write.

Dr. Arthur Whimbey has analyzed habits of poor and good readers. (1975) Poor readers frequently skim material, do not sustain attention, fail to select out relevant data, and jump to conclusions. Good readers often proceed slowly and attentively, engage in subvocalizations and internal dialogues, direct their thinking, analyze material into basic units, develop a sense of meaning, gather evidence to support their conclusions, and reconstruct relations within the argument to form their own concepts. Unfortunately many college students, even at advanced levels, do not behave like good readers.

Whether performing successfully or unsuccessfully, students who cannot analyze, who fail to understand what they are studying and who cannot direct their thinking productively present us with a significant learning problem. There are encouraging signs that this problem is being addressed effectively. One solution that we have been working on is a cognitive skills approach to teaching and learning.

What is a Cognitive Skills Approach?

Higher education traditionally has been viewed as serving the purpose of imparting knowledge; implicit in this view is a theory of

knowledge that assumes it to be a copy of reality. This summary is surely simplistic; but it serves a purpose of contrasting widely held assumptions with our own. Cognitive psychologists, such as Piaget, have emphasized that knowledge is not a print of reality but a construction that proceeds in developmental stages, from simple concrete thinking to the most sophisticated formal operations. Whimbey's analysis of good readers suggests how an active intelligence is at work in constructing knowledge. A cognitive skills approach grows out of this view of learning. It aims to develop the capacity to construct knowledge rather than to impart knowledge. In contrast to traditional education, it seeks to train intelligence by explicitly developing thinking and learning skills.

The process of intelligent activity has been analyzed and described as a complex of skills that can be acquired, in much the same manner that one can learn a sport or an art form. In the latter areas one can watch and learn from experts performing successfully; in education, except in advanced research settings, one does not usually have the opportunity to watch the process. One is given the product in finished form through a lecture or a piece of writing. The process that lay behind the product seems at first fated to be hidden. But experts can verbalize their thinking; they can show how they approach a problem and attempt solutions. A cognitive skills approach calls for such verbalization, not only of experts but of all learners, so that they can have a sense of what steps they are following, what works and what doesn't, and why. Too often students fail to understand because they grab at answers rather than carefully analyze and direct their intelligence towards comprehension based on the evidence before them.

After examining a variety of cognitive skills approaches, we have arrived at a minimum of three conclusions that often serve as a set of assumptions for many such programs. 1) Intelligence can be conceived as an activity involving definite skills using concrete and formal operations leading from simple to the most advanced levels of knowledge. A cognitive skills approach develops intelligence. It is not primarily remedial education, even though it has proven very effective in remedial programs. 2) An active, problem solving approach in classes that requires discussion and provides frequent feedback is believed to be more effective than lectures or other methods that promote passivity in students. 3) Concentrated attention to intelligence training produces significant results, with the greatest potentiality for improvement lying in systems where there is a cooperative effort to focus on cognitive skills in all classes. There are other important points; but these serve to illustrate that a cognitive skills approach includes a philosophy and psychology of learning, a method, and an implicit institutional program for the most effective means of implementing that philosophy and method.

How to Teach Cognitive Skills

Shortly after World War II, Bloom and Broder attempted to raise the academic achievement of students at the University of Chicago by improving their thinking skills. A distinctive feature of their teaching was having students put their thoughts into words so that someone else could follow their paths from one state of knowledge to another. Scholastically successful and unsuccessful students were asked to vocalize as they solved academic reasoning problems. A striking difference was observed between the two groups. Unsuccessful students had not learned to make precise step by step analyses of

problems. Instead they were "one-shot" thinkers who tended to give up and guess when an answer was not known immediately.

A training program was developed by first recording and transcribing the vocalized solutions successful students used for a set of selected problems. Unsuccessful students then worked with a tutor, taking turns solving problems aloud and then reading the "model" solutions. They were encouraged to note and discuss differences between the model solutions and their own, and to try to correct weaknesses in their attack on problems. Students found that by vocalizing they not only communicated their thoughts to others, they also got a clearer picture of their approaches to problems and the areas that needed improvement. Systematic improvements were observed through training sessions. Students read with greater care and reasoned more actively and accurately. Also, the group showed a statistically significant gain on the university comprehensive examination, consisting of problems in various academic areas. The Bloom and Broder experiment is frequently cited as an early model of a cognitive skills approach.

A distinctive feature in a cognitive skills approach is intense verbal interaction that directs intelligence through questioning, analyzing, testing, observing and providing feedback in the solution of problems. Whimbey and Lochhead have been experimenting for a number of years with problem solving discussion formats to develop different aspects of analytical thinking, such as the formation of analogies and the understanding of ratios, parallel ideas, and metaphors in math, science, and literature respectively. (1979) A special focus at the University of Massachusetts' heuristic lab is to help students unlearn ineffective learning strategies, such as a

typical passive, unthinking approach to a problem. Students are encouraged to verbalize their thoughts in detail so as to learn the consequences of both correct and faulty ideas. The teachers' role is to encourage debate between students over which models seem to provide the best solutions. Greenfield reports on a program for engineering students at the University of Wisconsin, where professors are encouraged to share with students their scratch pads used in problem solving, not just the finished answers commonly presented in lectures. Students, in turn, are to share with professors their attempts, so that their teachers can understand how students approach solutions. In Israel teachers in several high schools are developing Socratic dialogues so that in every course their primary objective is to teach thinking. They have been very successful at raising the level of all kinds of students, particularly those who otherwise might not have been regarded as college potential. The emphasis in any cognitive skills program is consistently upon the process of learning rather than its products.

Another feature is the focus upon the student rather than the teacher or course content. Teaching is directed not only to where teachers would like students to end up, but where students are at the time of learning. Learning develops in stages. Effective teaching needs to know what stage students have reached before planning a curriculum for them. At Bloomfield College an Interdisciplinary Freshman Core Program, in existence for six years, has developed a cognitive skills approach in all Core courses, which include math, natural science, social sciences, humanities, and communication labs. All students are given diagnostic testing before planning their college program. Some students are placed in developmental reading, writing, and math courses in order to improve their basic skills

before entering the required Core courses. Diagnostic testing is also administered at the end of the courses to determine progress and to establish achievement level. Tracks for students at different levels have been designed in most Core courses. It was found that students placed in inappropriate skill oriented programs often lost interest and dropped out just as they do in traditional classes. Keeping close tab on student progress has meant greater academic achievement and lower student attrition.

Another concern in a cognitive skills approach is fostering the desire to learn. Research has shown that wanting to improve is a first and necessary step in intelligence training. Those who have improved intellectually through rigorous training programs have reflected an interest in learning. Some have argued that to stimulate interest there should be courses that are relevant to students. This was a major thrust of the program at Bloomfield College in its first year. Unfortunately, it was found that a curriculum designed for relevance failed to produce expected results. Instead of worrying about relevant subject matter, teachers now concentrate upon how students learn.

Motivating students to engage in the process of analytical thinking has been promoted by showing them how effective skills operate. Students are given much opportunity to try out new skills and to receive feedback on their mistakes and their improvement. Bloomfield faculty realized another mistake as they initially tried to provide feedback that was primarily in the form of positive reinforcement. Now accurate assessment of behavior is made regularly. The desire to learn analytical thinking is stimulated slowly through students' gradual recognition that they can really solve problems, understand

difficult material, and express their own ideas effectively, not only to peers but to the "experts". The Bloomfield approach is directed towards developing students as thinkers and communicators, not memorizers. The responsibility for learning is clearly placed on the student. Learning to assume that responsibility seems to be an important part of developing motivation.

Another feature of the Bloomfield Core Program is a developmental approach that is used in all courses. This involves a step by step process that carefully builds skills that provide the foundation for the next level of learning. It was at first thought that the developmental approach was appropriate only for remedial courses. That proved to be a misconception. Intelligence training, like learning a sport, requires that persons continue to practice fundamental skills and extend them to more sophisticated processes. They cannot be expected to jump immediately from one type of thinking to another.

In a Freshman Core class that was conceived as an equivalent to English composition, students read through a collection of natural science essays. For each class period, students had to bring with them a short paper about the reading assignment before it was discussed. In their papers they had to show that they understood the main point, could express it in their own words, and provide relevant data to support the conclusion they reached. In the beginning there were two grades given: Yes and No. (Faculty eventually grew restive with this system, wanting to make it more flexible with No-pluses or Yes-minuses. They later switched back to letter grades.) In class, students then had an opportunity to discuss how they arrived at their conclusions and to see how others, including the teacher, reached conclusions. This method has proven to be the most effective approach yet tried for this

about dazzling innovations before a large audience; but long experience has demonstrated that small groups, where students play an active role verbalizing their thinking processes and receive feedback from both teachers and peers, combined with individual conferences, provide the most fertile ground for learning development.

How to Prepare Teachers for a Cognitive Skills Program

George Bonham, editor-in-chief of Change Magazine, commented recently that a depressing fact of innovative programs in higher education is that they don't last, even if they are at first quite successful. There are exceptions, of course, which may only prove the rule. One reason why innovative programs fail is because they do not receive adequate institutional support. Another reason is that faculty needed to support new programs fail to see the need for innovation, in part because they have a jejune notion of learning. One educational researcher at the University of Massachusetts found that many teachers could not clearly and consistently articulate what they meant by learning; he reported they had no reliable index to tell when learning had actually occurred, or what kind and quality of learning had transpired. Experiences with a cognitive skills program have indicated that faculty need to have ongoing training to help them understand what is involved in the learning process of their students and themselves.

At Bloomfield College this training has been built into the Core's course planning, curriculum implementation and evaluation. Some faculty have been reading current psychology of learning, but this is not required. What has proven to be essential are regular bi-weekly meetings for faculty teaching the various Core courses,

course. Once students had learned to analyze scientific essays, it was assumed that they could handle literature. Assignments in Kafka, which had been deemed successful in previous years, this time were recognized as mistakes. Though a story such as "Metamorphosis" requires tough analytical thinking to understand its meaning, there is a jump between analytical problem solving required to understand science and the critical, imaginative thinking needed to make sense of a story. Writing about literature prompted students to fall back into bad habits of guessing, espousing opinions rather than reasoned thoughts, and careless perceptions. The Bloomfield Core faculty had several times learned bitter lessons from trying to do too much in a semester; a particularly impressive disaster occurred when four different types of material were used in one semester (sociology, philosophy, religion, and drama). The mistake with Kafka showed that even faculty learn to do new things slowly, needing time to learn from their mistakes and to get a clearer notion of how real learning actually occurs. For the time being, until a clear development from reading science to literature is worked out, works of fiction have been expunged from this "English" syllabus. A developmental sequence seems to be the most natural and the most effective way to learn at all levels. When followed, however, it often has the effect of greatly curtailing faculty expectations with respect to content coverage.

As in other places where improving cognitive skills is a primary objective, the Bloomfield Core Program utilizes small group discussions and a tutorial approach exclusively. Special lectures brilliantly presented, dynamic panel discussions, vibrant dramatic presentations, and prize winning media presentations have all been disappointing when judged by learning objectives. Faculty have often been enthusiastic

with long sessions before and after semesters to reflect, evaluate, and plan. Through intensive, cooperative efforts faculty learn to specify learning objectives, to link them in a developmental way, to coach each other in managing their classes, and to check in with each other to assure common, fair grading procedures. Since all Core courses are interdisciplinary, "specialists" often coach their colleagues who are approaching material that is foreign to them. These ongoing faculty sessions have built up cohesive faculty units, which is a major reason why this innovative program is growing stronger and has become firmly established as a required Core for all daytime freshmen. It seems highly unlikely that a program focusing upon cognitive skills, which is so divergent from traditional education, could survive without a vigorous faculty development program that is also an integral part of the ongoing teaching/learning activities.

Like other innovations a cognitive skills approach can be expected to encounter fear, anxiety, doubt, and even antipathy among faculty. It seems to run counter to so much that is assumed and revered in traditional education. Instead of focusing upon the product of learning, it centers on the process. Rather than put the teacher in the center of attention as the expert who imparts knowledge, it sets the student in the center. If a student fails to improve, this might indicate the failure of the teacher rather than just the incompetence of the student. Switching to a new style with different goals and assumptions, with no firm institutional reward system, can be frightening to teachers. Faculty development sessions can be vitally important, if they enable teachers to think through their own ideas about thinking, to shift their teaching style towards student learning

rather than content production, and to develop their own cognitive skills pertinent to effective teaching.

A major goal in faculty development for a cognitive skills approach will probably be one that helps faculty elaborate a new self-image of a good college teacher. At Bloomfield the typical notion of a college professor has been transformed by many of the Core teachers, who think of themselves as learning coaches. Certainly there are other appropriate metaphors that can be used in constructing a viable self-image for teachers. Faculty need the chance to define themselves in a way which gives them confidence and a sense of worthwhile accomplishment. It is too easy a temptation for insecure innovators to exaggerate the superiority of their new image and to arrogantly downgrade other approaches. Another temptation is to escape the vulnerability of change by reverting back to traditional roles and methods.

Even faculty committed to a cognitive skills approach, however, show resistance to some important aspects of the project. For example, if immediate, regular, consistent feedback is considered essential to students' development, then providing this feedback is extremely time consuming. At Bloomfield, students are now required to produce many papers. In one course alone, twenty-seven papers were required of each student in a semester. In the developmental approach, teaching basic skills of writing is combined with teaching advanced skills of analytical thinking. This requires teachers to grade an enormous amount of papers (multiply 27 times 15 or 20) in each semester; sometimes each paper must be graded twice, once for thinking, another for writing mechanics. Underlying faculty resistance there is often exhaustion and at times some cognitive dissonance with respect to

How Can A Cognitive Skills Approach be Evaluated?

Since this approach marks a radical departure from more traditional programs, it seems inappropriate to assess its worth in terms of typical academic achievement only. A basic assumption of many who develop a cognitive skills approach is that the abilities fostered are relevant to life situations beyond the confines of academia. A method of evaluating this approach might follow the lines advocated by Winter, Stewart, and McClelland in their research to determine whether or not a liberal arts education produces people with real life skills. In their initial research students from three types of institutions -- liberal arts, technical, and two-year colleges -- were required to compose original essays in response to reading about two situations. The essays were evaluated in terms of demonstrated abilities to classify material; analyze its constituent parts, make comparisons, produce evidence, develop arguments, and form general abstract categories that could be applied to other situations. The preliminary research indicated that liberal arts graduates did slightly better than others. But many students in all institutions failed to perform these intellectual tasks well. We believe that there is a need for more cognitive skills teaching and for new ways to assess such programs.

One such assessment mechanism is the College Outcome Measurement Project (COMP) sponsored by ACT. The COMP test examines six generic skills applied to real life situations; it appears to be an appropriate measurement device for skills oriented programs. Bloomfield College is now using COMP in a longitudinal study to chart the development of skills from entering freshmen through graduation. Other means of evaluation are available; and certainly more will be developed in the

Results of other programs, particularly those integrating insights of recent cognitive learning theory, have been encouraging. (Carmichael, Ryan, and Whimbey, 1979; Larkin, 1977; Lochhead and Clement, 1979; Marron, 1965; Peleg and Adler, 1977; Sadler, 1978.) Students have demonstrated improved ability to analyze difficult material, understand both what they are reading and themselves as learners, move from simple to quite complex materials within one year, communicate their thinking and understanding more effectively to others, and score higher on standardized tests. Students' comments from programs such as the ones at the University of Massachusetts and Bloomfield College have also reflected gains: "After a course like this I really know how to think"; "finally I worked through a tough problem (or book) and really understood it"; "I feel smarter."

More research is needed on the correlation between cognitive development and grade achievement. Sometimes students have seen the benefits of this kind of educational approach in terms of higher cumulative grade point averages. But other students have complained that the skills they acquire in these intensive learning programs are irrelevant for getting decent grades in most traditional courses. We believe that many courses are requiring too little thinking from students; often students are tested for remembering someone else's thinking, not for doing their own. A high correlation between a cognitive skills approach and grade achievement in such courses might be an indication of the failure of the former. There is a more important reason for a cognitive skills approach than merely improving traditional academic achievement; it is to help students develop intelligent responses to the multiplicity of challenges presented to them in their everyday lives.

innovative roles; for many did not think College teaching would involve so much coaching and paper correction. The time required to set up experiments, examine notebooks, and supervise problem solutions presents equivalent frustrations for science faculty. Thus faculty development sessions are needed not only for training but for therapy, to help members work through resistance that can be detrimental to teaching and personal well-being.

Why start a Cognitive Skills Approach?

Since this new approach has the potential of producing fear, anxiety, confusion, collegial enmity, and faculty debilitation, why bother with it at all? One answer might be an obvious one. The present educational system is not working well with large numbers of students. The examples cited at the beginning of this article are symptoms of deep, widespread trouble. Something better has to be developed. A program that is based upon new insights into the nature of human learning is worth a try. In places where it has been developed, results have been impressive. One of the first programs that had many features of the approach described here was started by Albert Upton, professor of English and Director of General Studies at Whittier College. In 1960 a front-page article in the New York Times reported that the average IQ of the 280 freshmen at Whittier increased 10.5 points on the California Test of Mental Maturity after the students took two freshman English courses developed by Upton. The pedagogy of Upton's program was similar to that of Bloom and Broder. Classes met four times a week, once for lecture and three times for problem solving and discussion of mental activities employed in analytical reasoning and comprehension. The latter was done in small groups with a tutor.

near future.

In addition to measuring the development of students, we believe that it is also important to measure the development of teachers, teaching, curricula, and learning institutions themselves. Probably one of the greatest tasks now facing this approach is to design comprehensive and far reaching assessment criteria and procedures.

Other Unfinished Business

Even when better evaluation measurements are designed and numerous cognitive skills programs are developing students' capacities to function more intelligently in everyday life situations, this approach is threatened, as are other innovative programs, with premature extinction. It may also be hampered by an overly narrow institutional framework. We have learned that to be really effective, this approach needs to extend beyond merely a few courses or even a Core program. It works best when it operates throughout an institution. When cognitive skills became the primary target of the Freshmen Core at Bloomfield, it was thought this program would help solve basic educational problems manifested in students' increasing inability to sustain traditional academic standards. But once developed, the Core courses overshot their original aim. Instead of merely developing analytical skills, which would allow teachers in upper division courses to concentrate upon content with traditional rigor, the Core courses generated new objectives for other courses. What began as an innovative means towards a conventional end has become an end in itself. Faculty who thought the Core would make teaching more advanced courses easier found themselves facing a whole new notion of what it means to be a teacher. We believe that continual attention to intelligence training is necessary to resolve many of the learning problems

confronting higher education today.

In addition to extension throughout the system, this approach needs institutional support that is rarely provided innovative programs. The reward system in higher education is still geared to specialists who impart knowledge, not to innovators and dedicated teachers. The latter need to be better rewarded and recognized. Departmental structures still are oriented towards acquiring content; these often preempt any concern to develop intelligence systemically. They need to be reexamined and reconstructed. This new approach may call for the revamping of the entire educational program of an institution. Even if this is not necessary, there is at least a need for bold, creative thinking and commitment towards organizational development that supports this emergent approach. We hope that as more cognitive skills programs are begun and become institutionalized, we shall be able to provide a subsequent report on innovative institutions that are dedicated to fostering the development of cognitive skills of students and teachers.

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